

SECTION 03490
GLASS-FIBER-REINFORCED PRECAST CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. This Section includes plant-precast glass-fiber-reinforced exterior concrete column covers, including embedded hardware, loose connection hardware, and integrated column cover framing.
- B. Related Sections:
 - 1. Division 5 Section "Structural Steel" for anchor attachment to steel framing.
 - 2. Division 7 Section "Joint Sealants" for sealing joints between column covers.
 - 3. Division 8 Section "Exterior Wall Systems - General", for requirements for exterior wall components.
 - 4. Division 9 Section "Painting", for requirements for painted finish.

1.3 DEFINITIONS

- A. GFRC: Glass-fiber-reinforced concrete.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide GFRC column covers and column cover frames capable of withstanding gravity, wind, seismic, and erection design loads as well as the effects of thermal- and moisture-induced volume changes, according to load factors and combinations established in PCI MNL 128, "Recommended Practice for Glass Fiber Reinforced Concrete Column cover."
 - 1. Design Loads: Refer to Structural Drawings for Design Loads.
 - 2. Design framing systems to withstand design loads with lateral deflections no greater than 1/240 of the wall height.
- B. Design column cover framing to provide for movement of framing members without damage or overstressing, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 100 deg F.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include GFRC design mixes.
- B. Shop Drawings: Detail fabrication and installation of GFRC column covers, including the following:
 - 1. Thickness of facing, GFRC backing, and bonding pads.
 - 2. Finishes.
 - 3. Joint and connection details.
 - 4. Size, location, and details of flex, gravity, and seismic anchors.
- C. Samples: Representative of finished exposed face of GFRC showing the full range of colors and textures expected, 12 by 12 inches and of appropriate thickness.

1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed GFRC column covers similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Manufacturer Qualifications:** A firm that complies with the following requirements and is experienced in manufacturing GFRC column covers similar to those indicated for this Project and with a record of successful in-service performance.
 - 1. Assumes responsibility for engineering GFRC column covers to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - a. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of GFRC column covers that are similar to those indicated for this Project in material, design, and extent.
 - 2. Participates in PCI's Plant Certification Program and is designated a PCI-Certified Plant for Group G, Glass Fiber Reinforced Concrete.
 - 3. Has sufficient production capacity to produce required units without delaying the Work.
- C. **Testing Agency Qualifications:** An independent testing agency qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. **Welding:** Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- E. **Fire-Test-Response Characteristics:** Where GFRC column covers are part of a fire-resistance-rated assembly, provide column covers identical to those used in assemblies tested per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. **Fire-Resistance Requirements:** Indicated by design designations from UL's "Fire Resistance Directory," from ITS's "Directory of Listed Products," or from the listings of another testing and inspecting agency.
- F. **PCI Manuals:** Comply with requirements and recommendations in the following PCI manuals, unless more stringent requirements are indicated:
 - 1. PCI MNL 128, "Recommended Practice for Glass Fiber Reinforced Concrete Panel."
 - 2. PCI MNL 130, "Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products."
- G. **Mockups:** Before installing GFRC, build mockups for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by CM.
 - 2. Notify Construction Manager seven days in advance of dates and times when mockups will be constructed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. In presence of CM, damage part of an exposed-face surface and demonstrate materials and methods proposed for repair of surface blemishes.
 - 5. Obtain CM's approval of mockups before starting installation.
 - 6. Maintain mockups during installation in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and transport units to avoid excessive stresses or damage.

1. Lift or support units only at points indicated on Shop Drawings.
 2. Place nonstaining resilient spacers of even thickness between units.
 3. Support units during shipment on nonstaining shock-absorbing material.
 4. Protect units from dirt and damage during handling and transport.
- B. Store units to protect from contact with soil, staining, and physical damage.
1. Store units with nonstaining resilient supports in same positions as when transported.
 2. Store units on firm, level, and smooth surfaces.
 3. Place stored units so identification marks are clearly visible.

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide continuous and true GFRC surfaces; nonreactive with GFRC and capable of producing required finish surfaces.
1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain, or adversely affect GFRC surfaces and will not impair subsequent surface treatments of GFRC.

2.2 GFRC MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
1. For surfaces exposed to view in finished structure, use white of same type, brand, and source throughout GFRC production.
- B. Glass Fibers: Alkali resistant, with a minimum zirconia content of 16 percent, 1 to 2 inches long, specifically produced for use in GFRC, and complying with PCI MNL 130.
- C. Sand: Washed and dried silica, successfully used in GFRC production, complying with composition requirements of ASTM C 144; passing No. 20 sieve with a maximum of 2 percent retained on No. 140 sieve.
- D. Coloring Admixture: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of GFRC and complying with chemical limits of PCI MNL 130.
- F. Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.

2.3 ANCHORS AND SUBSYSTEMS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts: ASTM A 307 or ASTM A 325.
- C. Finish: Zinc coated by hot-dip process according to ASTM A 123/A 123M, after fabrication, and ASTM A 153/A 153M, as applicable.

2.4 COLUMN COVER FRAME MATERIALS

- A. Steel Channels and Angles: ASTM A 36/A 36M, finished as follows:
1. Hot-Dip Galvanized: ASTM A 123/A 123M.

2.5 GFRC MIXES

- A. Backing Mix: Proportion backing mix of portland cement, glass fibers, sand, and selected admixtures to comply with design requirements, and as follows. Provide nominal glass-fiber content of not less than 5 percent.

1. Flexural Properties: Average yield strength of 900 psi, and average ultimate strength of 2200 psi at 28 days; ASTM C 947.
2. Maximum Water-Cementitious Ratio: 0.35.
3. Curing Admixture: 4 to 5 percent of total mix volume.

B. Coloring Admixture: Not to exceed 10 percent of cement weight.

2.6 COLUMN COVER FRAME FABRICATION

- A. Fabricate column cover framing and accessories plumb, square, true to line, and with connections securely fastened, according to Shop Drawings and requirements in this Section.
 1. Fabricate framing assemblies using jigs or templates.
 2. Install framing members in one-piece lengths.
 3. Fasten structural-steel framing members by welding. Comply with AWS D1.1 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 4. Weld flex, gravity, and seismic anchors to column cover framing.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Repair Painting: Touch up accessible damaged galvanized surfaces according to ASTM A 780.

2.7 MOLD FABRICATION

- A. Construct molds that will result in finished GFRC complying with profiles, dimensions, and tolerances indicated, without restraining shrinkage or damaging GFRC during stripping. Construct molds to prevent water leakage and loss of cement paste.
 1. Coat contact surfaces of molds with form-release agent.

2.8 GFRC FABRICATION

- A. Proportioning and Mixing: For backing mix, meter sand/cement slurry and glass fibers to spray head at rates to achieve desired mix proportion and glass content according to PCI MNL 130 procedures.
- B. Spray Application: Comply with general procedures as follows:
 1. Spray mist coat of matrix without glass fibers over molds to a thickness not exceeding 1/8 inch.
 2. Proceed with spraying up backing mix skin before mist coat has set, using procedures that produce a uniform thickness and even distribution of glass fibers and matrix.
 3. Consolidate backing mix by rolling or use another technique to achieve complete encapsulation of glass fibers and compaction.
 4. Measure thickness with a pin gage or another acceptable method at least once for each 5 sq. ft. of column cover surface. Take not less than six measurements per column cover.
- C. Hand form intricate details, incorporate formers or infill materials, and over spray before material reaches initial set to ensure complete bonding.
- D. Attach column cover frame to GFRC before initial set of GFRC backing, maintaining a minimum clearance of 1/2 inch from GFRC backing, and without anchors protruding into GFRC backing.
- E. Build up homogeneous GFRC bonding pads over anchor legs, maintaining a minimum thickness of 1/2 inch over top of anchor foot, before initial set of GFRC backing.
- F. Inserts and Embedments: Build up homogeneous GFRC bosses or bonding pads over inserts and embedments to provide sufficient anchorage and embedment to comply with design requirements.

- G. Curing: Employ initial curing method that will ensure sufficient strength for removing units from mold.
 - 1. After initial curing, remove column cover from mold and place in a controlled curing environment.
 - 2. Keep column covers continuously moist for a minimum of seven days. Maintain temperature between 60 and 120 deg F during this period.
 - 3. An acrylic thermoplastic copolymer dispersion may be used as a curing compound in lieu of moist curing. Use only copolymers shown, in published independent laboratory test data, to eliminate the need for moist curing of GFRC.
- H. Column cover Identification: Mark each GFRC column cover to correspond with identification mark on Shop Drawings. Mark each column cover with its casting date.

2.9 FABRICATION TOLERANCES

- A. Manufacturing Tolerances: Manufacture GFRC units so each finished column cover complies with PCI MNL 130 for dimension, position, and stud frame tolerances.
- B. Position Tolerances: Measured from datum line locations, as indicated on Shop Drawings.
 - 1. Column cover Frame and Track: Plus or minus 1/4 inch.
 - 2. Inserts: Plus or minus 1/2 inch.
 - 3. Special Handling Devices: Plus or minus 3 inches.
 - 4. Location of Bearing Devices: Plus or minus 1/4 inch.
 - 5. Block Outs: Plus or minus 3/8 inch.
- C. Column cover Frame Tolerances: As follows:
 - 1. Vertical and Horizontal Alignment: 1/4 inch per 10 feet.
 - 2. Spacing of Framing Member: Plus or minus 3/8 inch.
 - 3. Squareness of Frame: Difference in length of diagonals of plus or minus 3/8 inch.
 - 4. Overall Size of Frame: Plus or minus 3/8 inch.

2.10 FINISHES

- A. Finish exposed-face surfaces of GFRC units as follows to match CM's design reference sample. Column cover faces shall be free of joint marks, grain, or other obvious defects.
 - 1. Smooth Finish: Smooth uniform precast finish for painted finish.
 - 2. Painted Finish: Provide urethane metallic finish; specified in section 09900.

2.11 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Establish and maintain a quality-control program for manufacturing GFRC column covers according to PCI MNL 130.
 - 1. Test and inspect GFRC production. Include material acceptance testing, preproduction testing, aggregate production testing, wet production testing, and production testing after curing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Install clips, hangers, and other accessories required for connecting GFRC units to supporting members and backup materials.
- B. Lift GFRC units at lifting points established by manufacturer and install without damaging units.

- C. Install GFRC units level, plumb, square, and in alignment. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Maintain horizontal and vertical joint alignment and uniform joint width.
 - 2. Remove projecting hoisting devices.
- D. Anchor GFRC units in position by bolting or welding, or both, as indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as possible after anchoring is completed.
- E. Welding: Comply with AWS D1.1 and AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Protect GFRC units from damage by field welding or cutting operations, and provide noncombustible shields as required.
- F. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.

3.3 ERECTION TOLERANCES

- A. Erect GFRC units to comply with the following noncumulative tolerances:
 - 1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
 - 2. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Column cover: Plus or minus 1/4 inch.
 - b. Nonexposed Individual Column cover: Plus or minus 1/2 inch.
 - c. Exposed Column cover relative to Adjacent Column cover: 1/4 inch.
 - d. Nonexposed Column cover relative to Adjacent Column cover: 1/2 inch.
 - 3. Support Elevation from Nominal Elevation: As follows:
 - a. Maximum Low: 1/2 inch.
 - b. Maximum High: 1/4 inch.
 - 4. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
 - 5. Plumb in Any 10 Feet of Element Height: 1/4 inch.
 - 6. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
 - 7. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
 - 8. Face Width of Joint: As follows (governs over joint taper):
 - a. Column cover Dimension 20 Feet or Less: Plus or minus 1/4 inch.
 - b. Column cover Dimension More Than 20 Feet: Plus or minus 5/16 inch.
 - 9. Maximum Joint Taper: 3/8 inch.
 - 10. Joint Taper in 10 Feet: 1/4 inch.
 - 11. Differential Bowing, as Erected, between Adjacent Members of Same Design: 1/4 inch.

3.4 REPAIRS

- A. Repairs will be permitted provided structural adequacy of GFRC unit and appearance are not impaired, as approved by CM.
- B. Blend and mix patching materials and repair GFRC so cured patches match color, texture, and uniformity of adjacent exposed surfaces.
- C. Prepare and repair damaged galvanized coatings on metal framing, anchors, and subsystems with galvanizing repair paint according to ASTM A 780.
- D. Remove and replace damaged GFRC units when repairs do not comply with requirements.

3.5 CLEANING AND PROTECTION

- A. Perform cleaning procedures according to GFRC manufacturer's written instructions. Clean soiled GFRC surfaces with detergent and water, using soft fiber brushes and sponges, and rinse with clean water. Prevent damage to GFRC surfaces and to adjacent materials.

- B. Provide final protection and maintain conditions that ensure GFRC is without damage or deterioration at time of Substantial Completion.

END OF SECTION 03490